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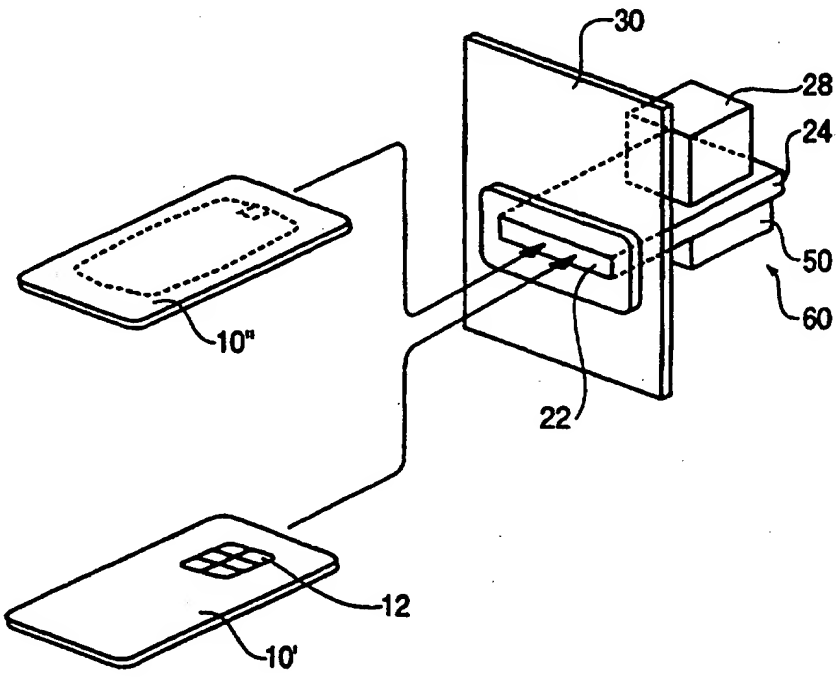

(57) Abstract

A smart card reader (60) includes a housing (24) having a card-receiving slot (22) formed therein. The reader includes a first circuit (50) for reading a proximity type smart card disposed adjacent to or inserted into the slot, and a second circuit (28) for reading a contact type smart card inserted into the slot.

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SMART CARD READER WITH DUAL MODE READING CAPACITY

BACKGROUND OF THE INVENTION

The present invention relates to a smart card reader for reading security access cards, and in particular, smart cards.

At the present time smart cards are used for many applications including as keys to gain entry into or out of buildings, parking garages or the like, and for financial transactions, e.g., money machines, ATM's, debit cards and fare transactions. These cards and their associated readers offer greater security over traditional tumbler locks in the access field and over written transactions in the financial field, because the card code programmed into the card cannot be readily copied. Thus, unauthorized use using a copied card is greatly reduced. Furthermore, because the card reader is typically attached to a host computer, the code on the card can be saved in the computer's memory, keeping tally of the use of the card and of the data thereon.

Traditionally, access cards and in particular financial cards required direct contact with the associated reader. These cards are known as "contact" cards.

The contact card is provided with, for example, interconnect pads, and is inserted into a special contact card reader for the reading of the code. The contact card readers used with contact cards are typically provided with probe-type

electronics that contact the interconnect pads on the card, so that the contact card reader can "read" the data or code on the card, transmit the code signal to a host computer, and then carry out the desired transaction whether it be subsequently unlocking or of a door or gate or the providing of desires cash at an ATM

Another type of smart card which has gained in popularity in recent years is known as a radio frequency identification (RFID) proximity sensor card. These cards allow a user to simply pass the smart card in front of a known RFID proximity reader, otherwise known as a contact-less card reader, from a distance of a few inches up to several feet away. One such reader is disclosed in commonly assigned United States Patent No. 5,099,227, the subject matter of which is incorporated herein by reference.

Known RFID proximity readers contain, for example, a magnetic coil which transmits a field or signal to energize the associated RFID card. The RFID card contains a microchip pre-coded with data. The energy from the reader activates the microchip, which in turn magnetically, electro-statically and/or electromagnetically, sends the pre-coded data back to the reader and attached host computer for verification or other use. An LED signal and/or audio tone may be activated to let the user know the code was verified.

Both of the aforementioned card and reader systems have associated advantages and disadvantages. For example, contact

cards can be misread, if the card is put into the card reader upside down or backward. However, contact cards and their associated readers are generally less expensive to initially implement than RFID card and reader systems.

On the other hand, misreads of the RFID cards are virtually nonexistent, regardless of how the RFID card is presented to the reader. Furthermore, RFID cards can be read simply by passing the card in front of the reader. Additionally, since RFID cards do not require direct contact between the card and the reader, dirt or other foreign material that may be present on the card will generally not interfere with the reading of the card by the reader. As such, RFID card and reader systems are generally more reliable. However, as noted above, RFID cards are generally more expensive than the cards of contact card systems.

As such, because of the advantages and disadvantages associated with both types of card and reader systems, both types of systems are widely used, depending on a user's specific applications.

Because these two different types of cards are currently available, each of which requires a specific type of reader, users may be required to carry both types of cards. For example, if a system owner, e.g., a building owner or bank, provides a system that requires a user to use a contact card in conjunction with a contact reader, but subsequently decides to switch over to a contact-less system, the owner will be

required to replace all of the contact cards in use, and all at the same time, which may be prohibitively expensive. Alternatively, the owner could install an RFID reader to be used in conjunction with the already present contact card reader. In this scenario, users could be issued, on a more gradual basis, RFID cards to be used with the associated reader, so that the owner could slowly phase out the contact card system. However, this would result in the disadvantage that two readers (and thus two separate housings) must be accommodated, which could be aesthetically displeasing and may require more space than is available for the particular location. Furthermore, for at least a period of time, the users of the cards may be required to carry with them both types of cards, until the new reader system becomes fully operational.

A further disadvantage of either system is that once the owner of the card reading system installs either a contact type system or a contact-less type system, he is committed to using the associated cards that will work with his system. Thus, if the owner installs the contact-less type system, he will be required to issue the more expensive RFID cards to all of the users of the system, regardless of the needs of the individual user.

To overcome some of the above noted problems, it is known particularly in the financial and credit card fields, to integrate into one card the necessary electronics for both a

contact and a RFID card. Thus, only one card is required to access both the large exciting base of contact type reader systems and the growing number of reader systems. However, this combination-type card is expensive. Since the cards are typically issued to a large number of users, the final cost can be very high.

SUMMARY OF THE INVENTION

It is an object of the present invention to avoid the aforementioned drawbacks by providing one card reader that can read either a contact smart card or a proximity (contact-less) smart card.

The above and other objects are accomplished according to the invention by providing a smart card reader with a housing having a card-receiving slot formed therein. First circuit means are mounted on the housing adjacent the card receiving slot and including an antenna mounted adjacent; said housing for reading a proximity smart card disposed adjacent said antenna and second circuit means are provided on the housing for reading a contact smart card inserted into the slot.

According to various embodiments of the invention, depending on the position of the antenna, the contact-less card can either be read when inserted in the slot or when placed adjacent the front plate of the dual reader.

Moreover, preferably the data outputs from the two reading arrangements are combined into a common output which is fed to

a host computer, with the data output of the reading arrangement for the contact-less card having its format charged to that of the contact card reading arrangement.

The invention will be described in greater detail in connection with an embodiment thereof that is illustrated in the drawing figures.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a perspective illustration of a known combination card that includes the elements of both a contact card and proximity card.

Figure 2 is a perspective illustration of a known contact card and associated card reader.

Figure 3 is a perspective illustration of a known contact-less, proximity card and associated contact-less card reader.

Figure 4 is an additional illustration of the known contact card reader.

Figure 5 is a perspective illustration of a contact-less module used in connection with the present invention.

Figure 6 is a rear perspective view of a dual mode reader according to an embodiment of the present invention.

Figure 7 is a front perspective view of the dual mode card reader according to the present invention being used with the known contact card and known proximity card.

Figure 8 is a front perspective view of a further embodiment of a dual mode card reader according to the invention.

Figure 9 is a front perspective view of still another embodiment of a dual mode card reader according to the invention.

Figure 10 is a block circuit diagram of the circuit of the preferred embodiment of the dual mode card reader according to the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to Figures 1-5, a known combination card 10 is illustrated. This known combination card 10 includes both the interconnect pads 12 and circuitry for use with a contact reader 15, and additionally includes the antenna 16 and the necessary circuitry for use with the known contact-less, i.e., radio frequency identification proximity card reader 20. Additionally illustrated is a known contact card 10' and a known proximity card 10". The known combination card 10 can be used with either the proximity reader 20 or the contact reader 15. The known contact card 10' must typically be used in connection with the known contact reader 15, and likewise, the known proximity card 10" must be used in connection with the known proximity reader 20.

In use, the known proximity card 10" is passed in front of the proximity reader 20, causing an electric and/or a magnetic

field of a first frequency produced by the proximity reader 20 to energize the proximity card 10". The energy received by the proximity card 10" causes data contained within a microchip (not shown) contained on the card to be read out and conveyed or transmitted at a second frequency, where it is received by an antenna of the proximity reader 20. The data is then sent via a cable (not shown) to a host computer (not shown). As noted earlier, such reader arrangements are old and well known in the art.

When the known contact card 10' is used, the card is inserted into the slot 22 which is present within the card housing 24. Once inserted, the interconnect pads 12 come into contact with the contacts 26, thus coupling the electronics 28 with the card 10'. As noted earlier, this type of card reader arrangement is likewise well known in the art.

The known contact reader 15 typically includes a face plate 30. Housing 24 is arranged to project transversely away from the face plate 30, so that an opening of the slot 22 is essentially flush with the face plate 30.

Adjacently arranged on the top surface of the housing 24, i.e., the surface extending parallel to the plane containing the card receiving slot 22, are the electronics 28 for the reader. The electronics 28 include the contacts 26, which project into the slot 22. When the card is inserted into the slot, contacts on the card come into contact with the contacts 26, thus completing an electrical connection. The data read by

the electronics are sent via a date output cable 29 to the host computer.

As shown in Figure 5, the module 50, which is essentially a reader 20, used for coupling power to and reading the contact-less card (either magnetically, electromagnetically, capacitively or a combination of same) includes an antenna, for example, a coil 56 for magnetic coupling, and associated electronics that are connected to a data output cable 55 that leads away from the module 50.

Referring also to Figures 6 and 7, a combination reader 60 in accordance with the present invention is shown. In these illustrations, the module 50 illustrated in Figure 5 is electrically connected or coupled with the electronics 28 for the known contact card reader 15 using the cable 29. As illustrated in these figures, the combination reader 60 includes card housing 24 having the card receiving slot 22 formed therein. The electronics 28 are situated on one side of the card housing 24 for coupling with and reading a contact card in the slot 22. The module 50 for coupling with and reading a contact-less card in the slot 22 preferably is mounted or situated on the side of the housing 24 opposite that occupied by the electronics 28. As illustrated, the components for both readers are located adjacent to the slot 22 for access to and coupling with a card inserted therein. Preferably the proximity or RFID reader or module 50 is positioned so that its

antenna, e.g., the coil 56 (Fig. 5), extends parallel to the plane of the slot 22, and thus of a card disposed therein.

As best shown in Figure 7, the combination reader 60 is capable of receiving and reading either the known contact card 10' or the known proximity card 10", depending on the user's choice. The combination reader 60 is also capable of coupling with and reading the known combination card 10.

Although, as indicated above, the preferred embodiment of the combination reader 60 involves insertion of the card, whether it be of the contact, contact-less (proximity) or combined type of card, into the slot 22, it may be desirable under certain circumstances not to require insertion of the card into the slot 22 in order to read either a contact-less or a combination type card. For this purpose, as shown in Figure 8, the dual mode reader 60 of Figure 7 is modified to provide the reader 60' wherein the antenna for the reader module 50, i.e., the antenna coil 56' as shown, is not disposed on the housing 24 in a plane parallel to the plane of the slot 22, but rather is mounted on the front plate 30 so that it extends essentially perpendicular to the plane of the slot 22, and essentially parallel to the plane of the front plate 30. Preferably, as shown, the antenna 56' is disposed above the plane of the slot 22, but is to be understood that if desired it may equally well be placed below the slot 22. Additionally, if desired, the dual reader 60 of Figures 6 and 7 may be further modified to provide the dual reader 60" of Figure 9

wherein a front 30 prime may be provided which in addition to the essentially vertical portion, has a substantially horizontal portion 31 which extends forwardly from the portion of the front plate 30' containing the opening or slot 22, i.e., portion 31 extends substantially in the direction opposite the direction in which the housing 24 extends from the front plate 30'. As shown, in this embodiment, the antenna 56 primed for the proximity reader module 50 is now disposed in this substantially horizontal front plate portion 31, whereby the card may rest on the plate portion 31 for convenience or if received for an extended period of time.

The data output cable 29 of the proximity reader 28 and the data output cable 55 of the contact reader electronics 28 are fed to a host computer. These data output cables 29 and 55 may be individually connected to the host computer, and the respective data may be in the same or different formats compatible with the host computer, as desired. Alternatively the two data output cables 29 and 55 may be connected together and the data combined, in a known manner, in a single output cable containing data from either or both data output cables of the dual mode reader. For example, as shown in Figure 10, the two data output cables 29 and 55 are fed to a multiplexer or switch box 61 wherein the digital output signal from the contact reader electronics 28 on the output cable 29 and the digital output signal from the radio frequency tag reader module 50 on the data output cable 55 are combined and fed via

a common data output cable 62 to the data receiver or host computer 64. However, preferably as shown, the digital output signal from the radio frequency reader module 50 is first fed to a receiver or microprocessor 66 (which may likewise include a driver circuit) wherein the output signal from the radio frequency reader module 50 is converted, in a well known and conventional manner, to a digital signal of the same form and format as the output signal from the contact reader electronics 28, and it is the output signal from this unit 66 which is in fact then fed or connected, for example, via the multiplexer 61, to the common output cable 62 which is connected to the data receiver 64. In this way, the output signal from the dual mode reader 60, 60' or 60" can be fed to a single input port of the data receiver 64 which will then process the data fed in without regard to which of the two reader modules 28 or 50 was actually used to read the particular card. Moreover, with the arrangement of Figure 10, a dual mode reader 60, 60' or 60" according to the invention can be used to directly replace a contact card reader in an existing installation in a simple manner and without requiring any change in the existing wiring. Of course, it is to be understood that the unit 66 may be included physically in the module 50, in the electronics unit 28 or as a separate unit of the dual mode reader according to the invention, as desired.

By providing a combination reader 60, 60' or 60" that can read both contact and contact-less (proximity) types of cards,

the need for two different readers is eliminated. Thus, the present invention can be installed using less space, and at a lower cost. Moreover, with a combination reader 60 as shown wherein insertion of a card into a slot 22 is required, the presence of a card in the slot 22 may be detected and used to turn on the reader module 50 to cause same to produce the energizing field for the card at a first frequency as described. The combination readers 60' and 60" have the advantage of not requiring a proximity or combination card to be inserted into the slot and thus enabling the card to be read even if the slot 22 has been vandalized, i.e., stuffed with chewing gum.

The foregoing is a complete description of a preferred embodiment of the invention. Various changes may be made without departing from the spirit and scope of the present invention. The invention, therefore, should be limited as set forth in the claims.

WHAT IS CLAIMED:

1. A dual mode smart card reader, comprising:

a housing having a card-receiving slot formed therein;

first circuit means, mounted on the housing adjacent the card receiving slot and including an antenna mounted adjacent said housing, for reading a proximity type contact-less smart card positioned adjacent said housing and for producing a corresponding first output signal; and

second circuit means mounted on the housing for reading a contact smart card inserted into the slot and producing corresponding second output signal.

2. The dual mode smart card reader defined in claim 1, wherein said first circuit means for reading a contact-less card reader comprises a radio frequency identification proximity card reader.

3. The dual mode smart card reader defined in claim 1, wherein said second circuit means comprises a contact card reader having at least one contact probe projecting into the slot for engagement with a contact on a contact card inserted into said slot.

4. The dual mode smart card reader defined in claim 1, further comprising a face plate having an opening therein; and

wherein said housing is inserted into the opening and projects essentially perpendicularly to said face plate.

5. The dual mode smart card reader defined in claim 4, wherein said second circuit means is disposed on a surface of said housing extending parallel to a plane containing said slot.

6. The dual mode smart card reader defined in claim 5, wherein said first circuit means is disposed on a surface of said housing which is opposite said surface of said housing on which said second circuit means is disposed.

7. The dual mode smart card reader defined in claim 6, wherein said antenna of said first circuit means is disposed substantially parallel to said plane of said slot.

8. The dual mode smart card reader defined in claim 7 wherein said antenna is disposed adjacent said surface of said housing which is opposite said housing surface on which said second circuit means is disposed, whereby said first circuit means can read a proximity card inserted into said slot.

9. The dual mode smart card reader defined in claim 7 wherein said opening is formed in a first position of said face plate which has a further portion which extends essentially

perpendicular to said first portion in a direction opposite that of said housing; and said antenna of said first circuit means is disposed on said further portion of said face plate.

10. The dual mode smart card reader defined in claim 6 wherein said antenna is mounted on said face plate and extends substantially perpendicular to said plane of said housing.

11. The dual mode smart card reader defined in claim 1 which said antenna is a coil.

12. The dual mode smart card reader defined in claim 2 further comprising:

further circuit means for converting said first output signal from said radio frequency reader to a format corresponding to that of said second output signal from said second circuit means; and a common signal output from said dual mode card reader for said second output signal and from said further circuit means.

13. The dual mode smart card reader defined in claim 2 further comprising:

further circuit means, connected to an output of each of said first and second circuit means, for combining said first and second output signals to provide a common output signal for said dual mode card reader.

14. The dual mode smart card reader defined in claim 13 wherein said means for combining comprises a multiplexer connected to receive said first and second output signals.

15. The dual mode smart card reader defined in claim 13 further comprising:

converter circuit means, connected between said output of said first circuit means and said further circuit means, for converting said first output signal from said radio frequency reader to a format corresponding to that of said second output signal from said second circuit means and for feeding the converted signal to said further circuit means in lieu of said first output signal.

16. The dual mode smart card reader defined in claim 1, wherein said first circuit means and said second means are electrically connected together.

17. The dual mode smart card reader defined in claim 1, wherein said first circuit means and said second means are not electrically connected together.

FIG. 1
(PRIOR ART)

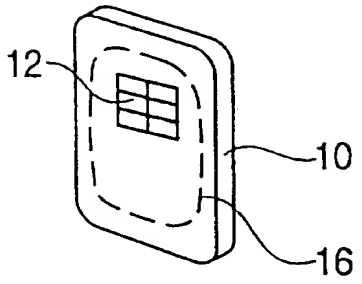


FIG. 2
(PRIOR ART)

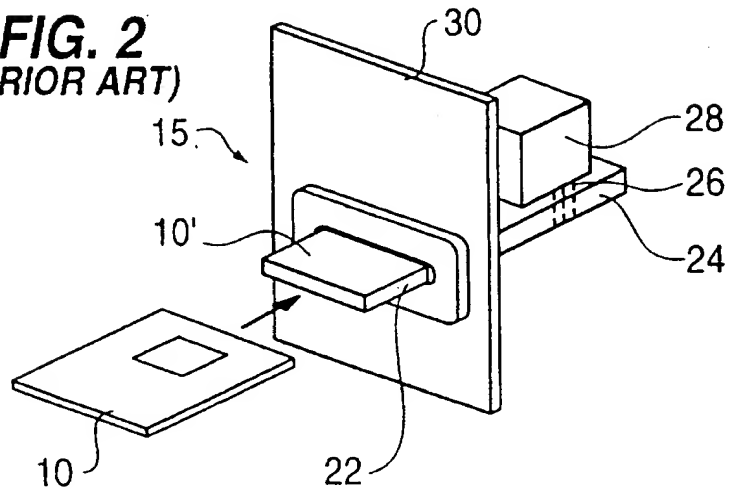


FIG. 3
(PRIOR ART)

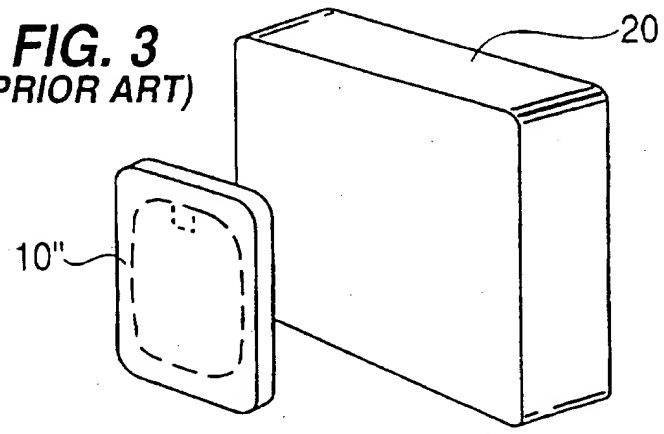


FIG. 4
(PRIOR ART)

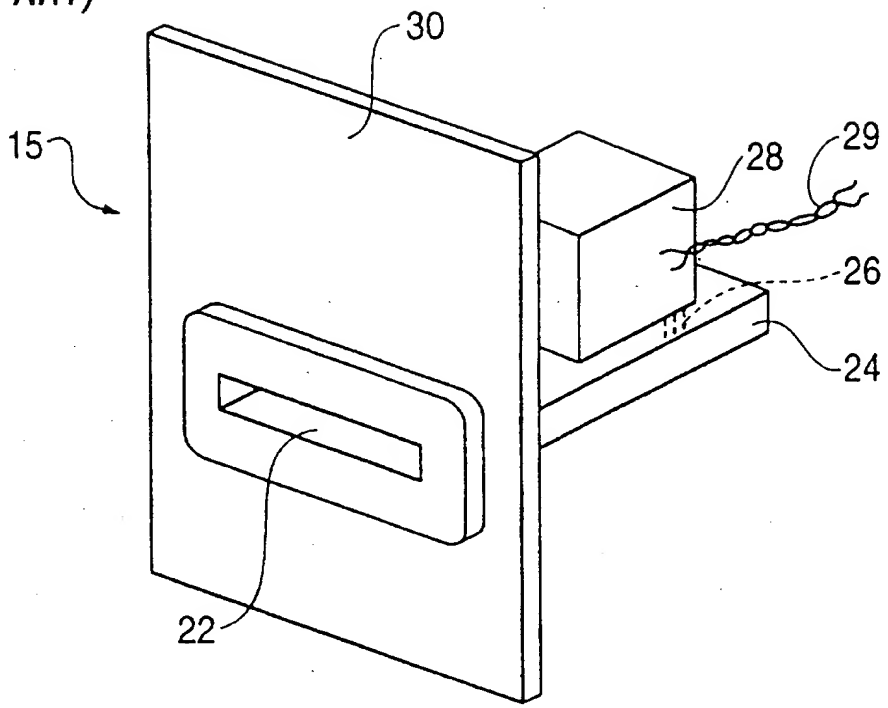


FIG. 5

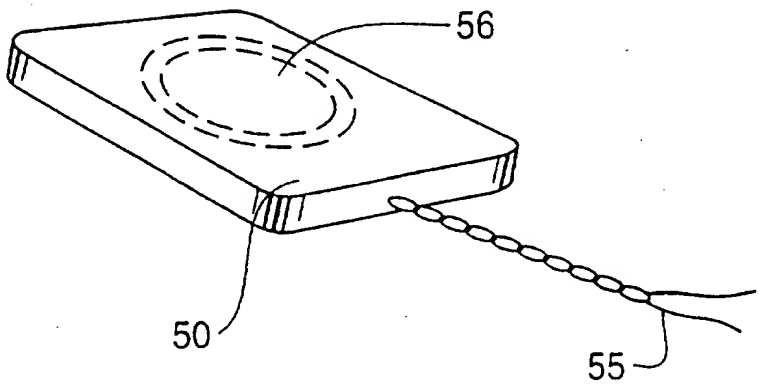
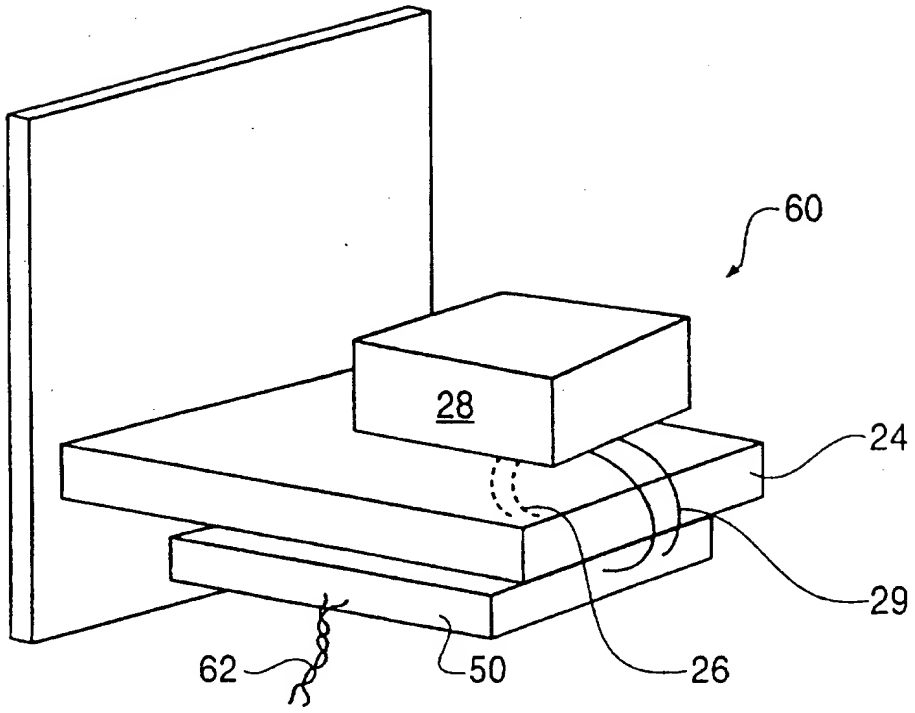


FIG. 6



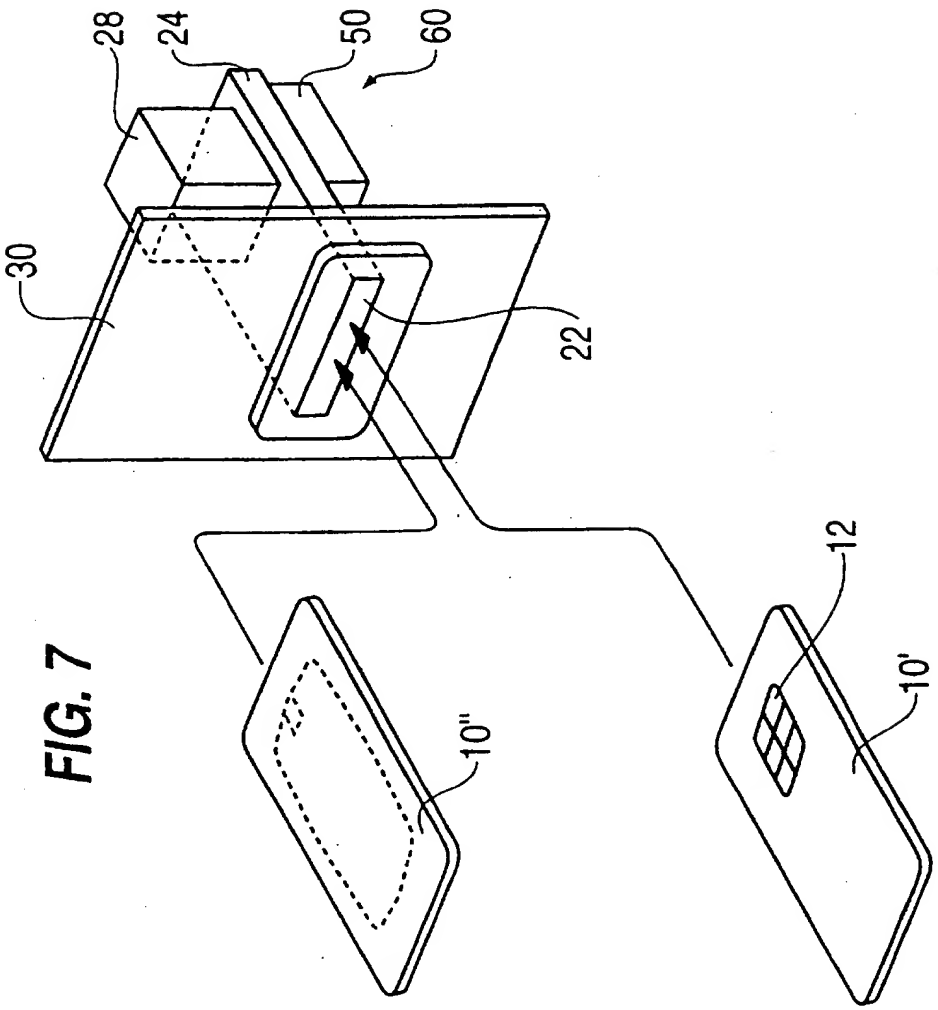


FIG. 7

FIG. 8

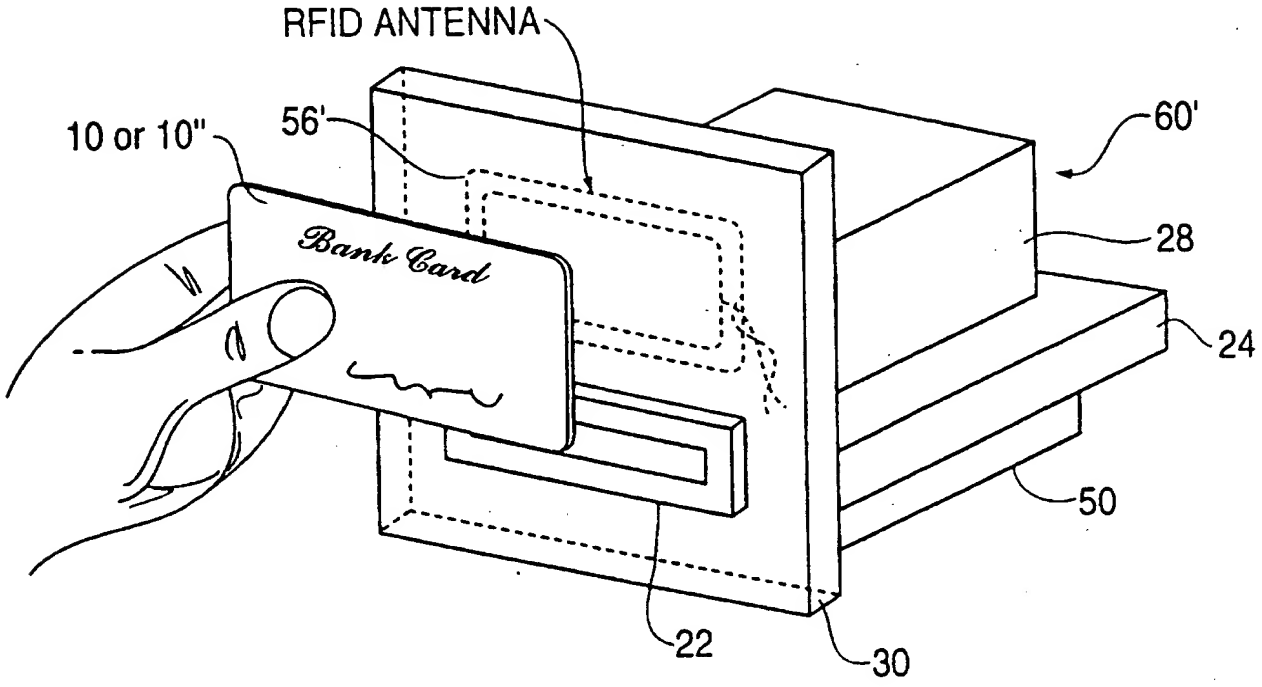
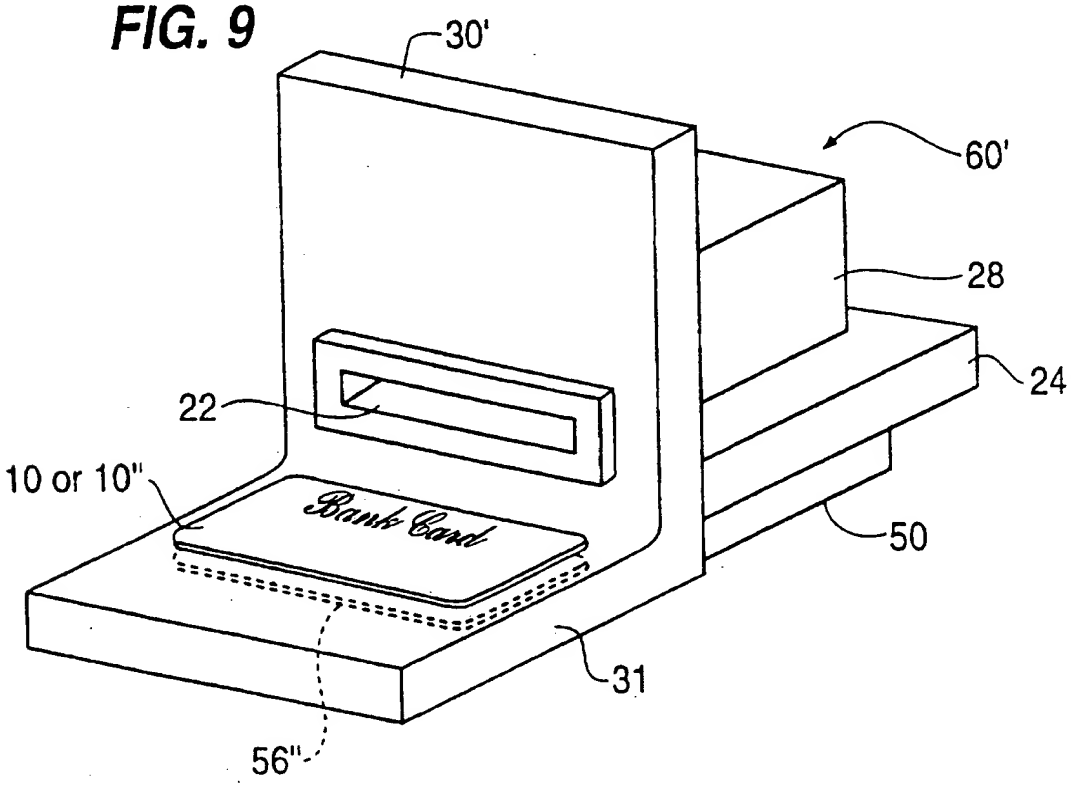


FIG. 9



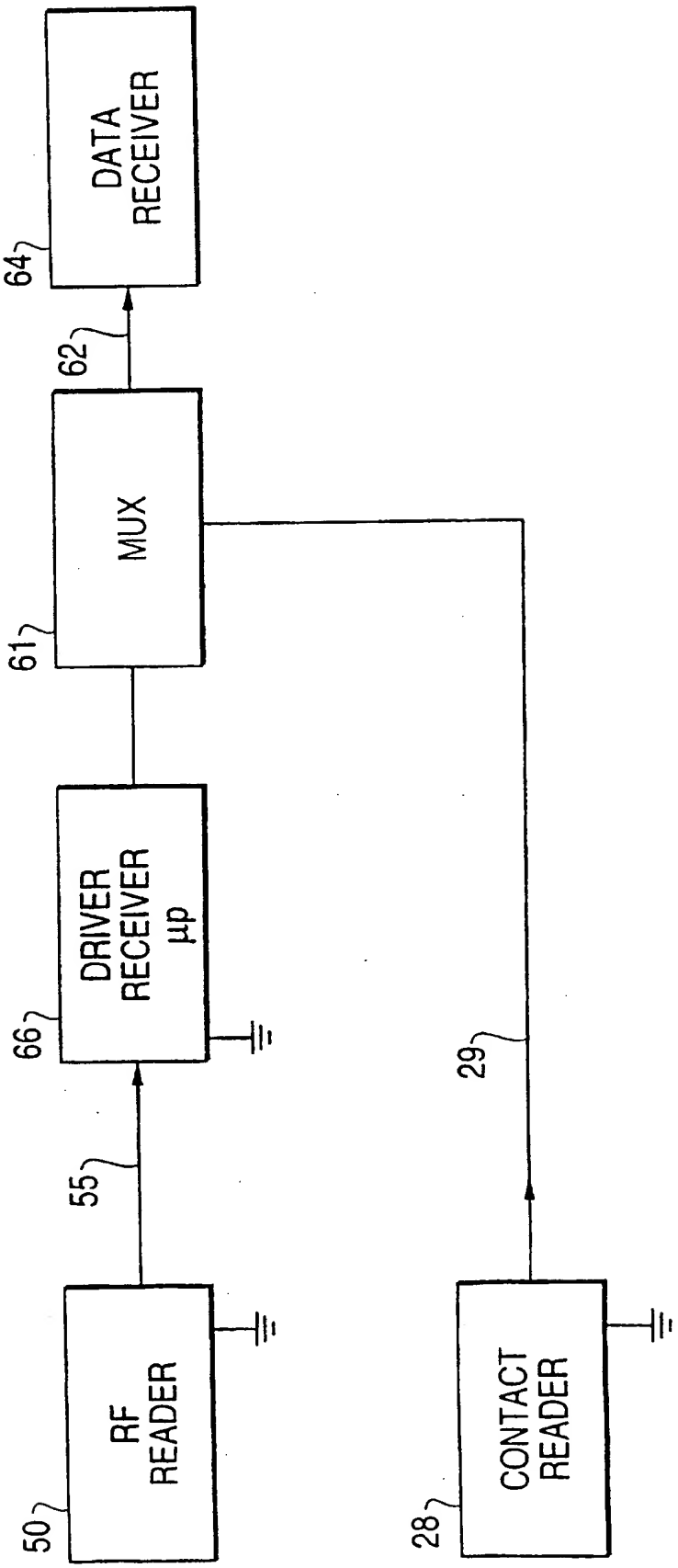


FIG. 10

INTERNATIONAL SEARCH REPORT

[redacted] Application No
[redacted]/US 97/09381

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 G06K7/06 G06K7/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 G06K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	EP 0 637 810 A (AMPHENOL TUCHEL ELECT) 8 February 1995 see column 2, line 5 - line 27 see column 2, line 49 - column 3, line 18 see figures 1-5	1-9, 11-17 10
X A	US 5 382 781 A (INOUE TAKESHI) 17 January 1995 see the whole document	1-6, 10-17 7-9
A	US 5 296 692 A (SHINO KATSUHIDE) 22 March 1994 see column 6, line 7 - line 68 see claims 1,4	1

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☒ Patent family members are listed in annex.

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Information on patent family members

International Application No
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